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ABSTRACT

The present study was designed to identify parent-child interaction patterns that might differentiate bright from below average elementary students in order to test the hypothesis that environmental processes related to regulation of executive processes influence both children's learning and developmental level. Thirty-two mother-child dyads (16 high and 16 low achievers) participated in a one-hour experiment that was videotaped. The experimental tasks consisted of copying block design models, categorizing sets of pictures, and categorizing sets of words. The parent-child interactions were coded in terms of questions asked, responses, and other verbal and nonverbal communications. The results supported the conclusion that differences in parent stimulation are of greater importance than socioeconomic or educational status. Bright students tended to have family environments in which considerable verbal guidance in problem-solving situations is provided and independence is fostered. (BW)

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Identification of Parent-Child Interaction Characteristics of High and Low Achieving Elementary Students

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The literature on environmental factors that influence children's intellectual growth suggests that parental involvement is of utmost importance. In a recent review of 47 compensatory education programs (Mullin and Summers, 1983), it was noted that the effect of education interventions on student performance tends to be slight, unstable and of short duration. On the basis of studies surveyed, the authors concluded that ". . . there is no input, no approach, no program characteristic that is repeatedly found to be relatively or absolutely effective - with the possible exception of parental involvement" (p. 342). Similarly, Lazar and Darlington (1982, 1977) noted that early age intervention programs which involved parents tended to show positive effects on children's development. Yet, parental involvement has not been operationalized in a way that can be studied or applied in a systematic manner.

Hundreds of parent-training programs have been initiated at costs in the millions of dollars that are spurred on by the findings described earlier and those stemming from the Coleman Report (1966). However, they appear to be guided by a rather vague conception as to how complex learning processes develop and how these are influenced by the family environment. A developmentally-based theory geared towards unraveling the role of home environments in relation to scholastic achievement is still to be formalized and tested. Although current research indicates that the home environment accounts for more of the variance in intellectual performance than school factors, empirical data on the former remains unsystematized. Too often contextual variables, such as family

size, parental, marital and socio-economic status, number of rooms in the home and expectations, that merely stand as proxies for possibly more informative parent-child interaction processes, are studied in a piecemeal fashion. There is a longstanding gap between the identification of the problem (i.e., how do familial processes influence intellectual development and program implementation. We need more developmental (cross-sectional and longitudinal) research on family processes that is guided by a theory of intellectual growth. Until a greater priority is placed on research based on a sound theory of intellectual development, educational interventions will inevitably continue to be remedial and thus, less cost-effective.

Literature Overview

Both theory and research suggest that the parental involvement effect may be found in the social interaction between parent and child (Bandura, 1977; Bausell and Bausell, 1979; Bernstein, 1961; Freeberg and Payne, 1967; Hess and Shipman, 1969; Vygotsky, 1962, 1978; Wertsch, 1979). Differences in parent-child interaction between socio-economic groups have been observed with younger children (Bee, Greissguth, Van Egeren, Nyman and Leckie, 1968; Golden and Birns, 1968; Bordrin and Henggeler, 1981; Kogan and Weinberger, 1969). However, few studies have examined differences in parent-child interaction in relation to student performance with school-aged children (Portes, submitted for publication). Additional research in this area is needed before well-designed, prevention-oriented parent training programs can be implemented to

improve the cognitive performance of low achieving students. Bergan, Newman and Karp (1983) report that even a brief period of parent training is sufficient to improve arithmetic skills of low achieving pre-school children in the short term. Parent education implemented in a Follow Through program (Rubin, Olmsted, Szegdon, Wetherby and Williams, 1983) has had a longitudinal, positive effect on grade retention and drop-out rates for participants. In spite of serious limitations, studies such as these suggest that even moderate changes in the child's environment may influence changes in intellectual performance.

Theoretically, the social interaction between child and more mature individuals can be considered critical to the development of cognitive skills. In such interactions, Vygotsky (1978) has proposed that key learning processes related to the management of information (regulatory or executive processes) occur which advance the child's developmental level. To the extent that parent-child interaction patterns contain or serve to model this type of learning (regulatory or executive) cumulatively, we can expect corresponding changes in the child's developmental level in any one of various intellectual skills. Consequently, many of the cognitive skills the child learns, that serve to regulate information or to facilitate problem-solving, are initially developed in the social plane and only later internalized.

Executive processes represent one aspect of human intelligence that has been recognized recently in Sternberg's, (1984) triarchic theory of intelligence. They include pre-performance cognitive

events such as: a) analyzing a problem situation to determine what resources or information are needed; b) sequencing mental operations such as retrieval; representation of relevant features in short term memory; or c) determining if additional external information or new strategies are required for generating an effective response sequence. Sternberg is also aware of the problem confronting those who seek to understand intellectual development and he notes that "to understand expertise (performance), one must understand first how current individual difference in knowledge evolved from individual differences in knowledge acquisition." (1984, p. 9). This is an ontogenetic question which some attempt to resolve rather atheoretically by postulating biologically-based models to account for individual differences.

A more functional and researchable model, based on the analysis of didactic, modeling processes found in human social interaction is currently being developed (Schubert & Cropley, 1973; Wertsch, 1979, 1980). Vygotsky (1978) notes that in order to understand individual differences in cognition, one must look beyond the individual's present development level to a second level which has been traditionally ignored. He calls it the zone of proximal development and refers to the difference between what a person can do on his own and what he can do with external help (regulation). In other words, two children with equal measured intelligence may differ in the extent to which they can benefit from external guidance and information. Such differences, in turn, may serve to account for children's varying ability to acquire knowledge in different

contexts. Vygotsky's approach suggests that environmental processes related to regulation of executive processes influence both children's learning and developmental level. If this is true, one would expect differences in social interaction patterns which relate to executive/regulatory aspects of intelligence to help distinguish among various ability groups. That is, one would expect to find differences in interaction style to relate to intellectual performance on the basis of the quantity and quality of guidance provided by parents.

The present study was designed to identify parent-child interaction patterns that might differentiate bright from below average elementary students in order to test the above hypothesis. The task situations were designed to simulate a part of elementary school children's home environment associated with parental guidance and learning.

Method

Subjects: Eight urban elementary school principals were asked to distribute requests to parents of fifth and sixth grade students for participation in the study. Out of approximately 100 returned request forms, which provided us with background information, sixteen high and sixteen low achievers were selected on the basis of the upper quartile and lower half of the distribution of scores in the California Text of Basic Skills. Selection procedures also controlled for race, sex, parental marital status, income and education to the extent possible. Table 1 shows descriptive statistics for the above background data.

Procedure: Mother-child dyads that met selection criteria were asked to participate in a one hour experiment that was videotaped. After a five minute warm-up period, the child was asked to copy six Block Design (WISC-R) models and the mother was told that she could help. After the sixth model was attempted, the child was allowed to continue until she chose to stop (up to a total of eleven models).

The second task required categorization of four sets of pictures (e.g. pencil, chalk, eraser, crayon). Each set was preceded by the instructions "Tell me which of these pictures should go together and tell me why." The mother again was told "You may help if you'd like." If the child or mother responded with a relational or two-picture combination, the E provided one categorical grouping, which included 3 objects in the beginning of the tasks (e.g., "pencil and eraser go together because you write with one and erase with the other" v.s. "pencil chalk and crayons are all used to write"). The third task was similar to the second except that words, rather than pictures, were used as stimuli. Four sets of four words each were presented to elicit parent-child interaction related to didactic practices.

The following measures were developed to assess communication characteristics between high and low achieving children and their mothers. They served to examine regulatory aspects of parental speech to children in school-related tasks:

Insert Table 1 About Here

Measures

MOPENQU	Number of open ended questions by mother
MCLOSQU	Closed ended questions by mother
CINTM	Child interrupts mother
CHQUES	Child asks question
	reinforcement by the mother
CREFMH	Child refuses mother's help
CAGREEM	Child agrees with mother's statement
MINT	Mother interrupts child
MFAILS	Mother attempts but fails in directing the
	child's response
MASKVP	Mother provides direction both verbally and
	physically (i.e., pointing)

In addition, children were asked to complete the Home Environment Scale developed by Moos (1969) which provided five measures. They related to cohesion (HECOH), conflict (HECON), expressiveness (HEXP), achievement motivation (HEACH), and independence (HEIND), dimensions in the home.

Reliability

Two trained, independent raters examined each of thirty-two transcripts, along with videotapes, and scored behaviors along the previously defined response categories. After independent scoring was done, disagreements were resolved by the two raters along with a third judge. The average reliability for the present measures was estimated at .83 and improved substantially after resolution of disagreements was reached.

Results

An effort was made to simplify the data obtained during the parent-child interactions. Measures that were associated with low reliabilities were excluded from further analyses. A discriminant analysis (Tatsuoka, 1970) was conducted to identify interaction measures that differentiated between the mother-child pairs of high and low achieving children. The design specified the RAO stepwise selection method which serves to maximize the overall separation of groups through a set of independent variables.

The variables selected through the above procedure composed a linear function that yielded an eigen value of 2.29, a canonical correlation of .83 and a chi-square of 29.02 (with 1 degree of freedom, $p < .002$). These process variables are shown on Table 2 along with their standardized canonical discriminant function coefficients that show their relative contribution in differentiating between groups. Table 3 shows the means and standard deviations of variables in the study. The above canonical discriminant function served to differentiate high from low achievers to a significant extent. This function represents an interaction style in which the mother is active in guiding the child's problem solving behavior through both open and closed-ended questions and verbal and physical directions. As a consequence, the child agrees with the mother frequently. The child's behavior is characterized by independence, as reflected by refusing the mother's direct help, his own report about that dimension of the home environment on the questionnaire and mutual interruptions. The

mother's stimulation and efforts to regulate the child's behavior are often unsuccessful. This style of interaction reflects a home environment that is responsive and which encourages active participation by the child. The discriminant function, based on this configuration of interaction measures, served to differentiate between high and low achievers in ninety-three percent of the cases. The canonical correlation squared is also a useful way of judging the relative importance of the present discriminant function. In the present study, 69 percent of the variance in the discriminant function (i.e., interaction style) is accounted for by group membership and vice-versa since the group variable and the interaction style reflected by the discriminant function are related significantly (.83). Finally, the obtained eigen value of 2.26 suggests that this function accounts for one-fourth of the variability present in the interaction measures. The latter were accurate in identifying 29 of 32 children as either high or low achievers.

Insert Tables 2 and 3 About Here

Discussion

The present results provide a functional interpretation of one aspect of children's home environment that relates to scholastic achievement. Differences in parent stimulation have been shown to be of greater importance than socio-economic, or educational status per se (Iverson & Walhberg, 1979; Wolf, 1964). The present findings

support that conclusion and furthermore, they focus on specific interactive processes that differentiate children's cognitive environments. Of all the process measures, the child's agreement with the mother made the greatest contribution to the determination of the discriminant function. It should be noted that this process variable requires the mother's involvement in information-processing functions related to problem-solving in order for the child to agree. In contrast, the mother's agreement with the child's statements or reinforcement of child behavior was not a useful variable for classification purposes. Consequently, the ability of the parent to deliver verbal directions, cues and problem-solving strategies appears to be a significant characteristic associated with high achieving students. The child's propensity to interrupt and behave independently also appears related to curiosity, participation and his demands on the resources available in the home.

In sum, bright students tend to have family environments in which considerable verbal guidance in problem-solving situations is provided and independence is fostered. Subsequent ecological research in this area needs to surmount the limitations inherent in the present selection method and sample size. The role of the father, in addition to that of the mother, also should be examined in similar semi-structured situations. The latter could be expanded in scope to include other contexts in which the child is routinely exposed to information and information-processing strategies. Finally, research involving parent training in guiding and stimulating children's cognitive potential should be initiated and

expanded. Creativity, motivation, and self-concept dimensions should also be considered in future assessments of children's home environments.

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Table 1
Description of Family Background Characteristics

	High Achievers N = 16		Low Achievers N = 16	
	X	SD	X	SD
Father's Education	14.0	4.4	9.1	5.0
Mother's Education	14.8	2.5	12.3	1.8
Family Income	28,556	14,182	11,152	9,819
Father's Age	37.7	12.9	34.6	5.3
Mother's Age	37.1	4.9	33.5	4.4
Family Size	2.9	1.2	2.3	1.2
Marital Status	11 intact/5 single parent		6/10 single parent	
Sex of Child	8 males/8 females		6 males/10 females	
Race	12 white/4 black		10 white/6 black	
Income				
less than 10,000	2		less than 10,000	8
10,000 - 25,000	4		10,000 - 25,000	5
more than 25,000	10		more than 25,000	3

Table 2
Standardized Discriminant Function Coefficients
for Interaction Measures

Variable	Function Coefficients
CAGREEM	-2.48066
CINTM	1.85579
MFAILS	1.80209
CREFMH	1.47296
MCLDSQU	-1.27359
HEIND	1.21378
MINT	1.04579
CHQUES	-0.81005
MASKVP	-0.79241
MOPENQU	0.50738

Table 3
Means and Standard Deviations
for Mother-Child Interaction Measures

	Variables									
	CAGREEM	HEIND	MINT	CHQUES	CREFMH	MFAILS	MASKVP	CINTM	MCLOSQU	MOPENQU
LOW ACHIEVERS $\bar{X}$	2.7	6.3	2.3	3.7	0.7	2.5	6.1	1.0	6.3	8.3
SD	2.4	1.6	3.2	3.8	1.6	1.6	5.0	1.5	5.4	8.8
HIGH ACHIEVERS $\bar{X}$	7.0	5.3	3.6	7.3	0.6	2.6	8.1	3.6	11.8	11.1
SD	7.4	1.9	5.5	6.8	1.2	2.3	7.0	7.2	10.5	14.7